

Potential Self-Assembly of Nanoparticles at the Interface of Microemulsions

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Hybrid nanomaterials involve the combination of individual properties from different types of nanostructures. For example the optical properties of gold nanoparticles can be combined with superparamagnetic properties of magnetite nanoparticles, which offer new aspects of biomedical application. In addition to the conventional synthesis from a specific prescription of starting materials, heterodimeric nanoparticles can result from directed reactions over self-assembled colloidosomes at a liquid-liquid interface [1].

Another approach to the synthesis of nanoparticles is redirected in microemulsions, with droplet dimensions of about 20 nm and thermodynamic stability, used as templates or nano-reactors [2,3]. Modulation of ternary mixtures of surfactant, oil and water components with nanoparticles can furthermore enhance interactions of nanoparticles in such microemulsions.

Our research involves the synthesis of gold-magnetite hybrid nanoparticles at the interface of microemulsion systems in presence of Dioctyl Sodium Sulfosuccinate (AOT) as surfactant. Therefore, gold nanoparticles (Au(PEI)-NPs) were dispersed in the aqueous phase, and superparamagnetic magnetite nanoparticles (MNPs) were dispersed in the hexane-pentanol organic phase. By mixing both colloidal dispersions in presence of AOT a large optically clear water-in-oil L₂-phase is observed (Fig. 1). Conductometric and calorimetric investigations indicate an accumulation of the nanoparticles at the oil/water interface at higher water content.

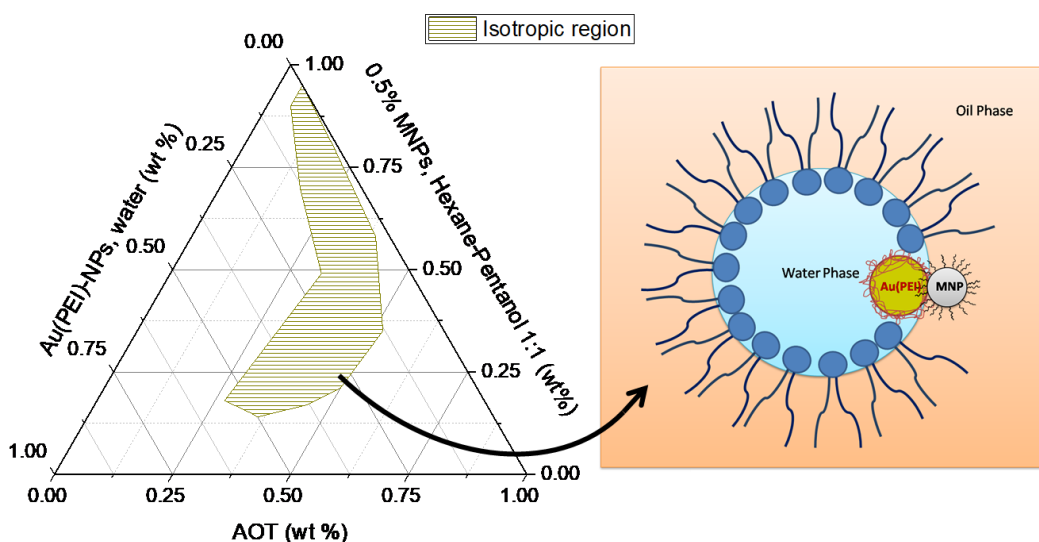


Fig. 1. Partial ternary phase diagram of the L₂-phase, with the corresponding microemulsion illustration, of the system hexane-pentanol (1:1)/AOT/water in presence of MNPs in the organic phase and Au(PEI)-NPs in the aqueous phase.

- [1] H. Gu et al., *J. Am. Chem. Soc.* **127** (2005), 34.
- [2] C. Note et al., *Coll. Surf.* **290** (2006), 150.
- [3] K. Lemke et al., *J. Coll. Int. Sci.* **394** (2013), 141.